Imaging and Multimedia Analytics at the Edge 2023

Conference Chairs
Jan P. Allebach, Purdue Univ. (US)
Raja Bala, Amazon.com Inc. (US)
Qian Lin, HP Labs, HP Inc. (US)

PROGRAM AND PROCEEDINGS

This document details the conference program, held as part of the 2023 IS&T International Symposium on Electronic Imaging, 15-19 January 2023. Manuscripts of conference papers are reproduced from PDFs as submitted and approved by authors; no editorial changes were made.

Society for Imaging Science and Technology
7003 Kilworth Lane • Springfield, VA 22151 USA
703/642-9090; 703/642-9094 fax
info@imaging.org; www.imaging.org

ISSN 2470-1173

https://doi.org/10.2352/EI.2023.35.7.IMAGE-A07

Imaging and Multimedia Analytics at the Edge 2023

Conference overview

Recent progress at the intersection of deep learning and imaging has created a new wave of interest in imaging and multimedia analytics topics, from social media sharing to augmented reality, from food and nutrition to health surveillance, from remote sensing and agriculture to wildlife and environment monitoring. Compared to many subjects in traditional imaging, these topics are more multi-disciplinary in nature. This conference will provide a forum for researchers and engineers from various related areas, both academic and industrial, to exchange ideas and share research results in this rapidly evolving field.

Paper authors listed as of 1 January 2023; refer to manuscript for final authors. Titles that are not listed with the proceedings files were presentation-only.

Imaging and Multimedia Analytics at the Edge 2023

MONDAY 16 JANUARY 2023

KEYNOTE: Data & Learning (M1)
Session Chair: Qian Lin, HP Inc. (United States)
8:45 – 10:20 AM
Balboa

8:45
Conference Welcome

8:50 IMAGE-264
KEYNOTE: Small data, big insights, *Raja Bala, Amazon (United States)*

Dr. Raja Bala is a principal applied scientist at Amazon. His research interests include computer vision, deep learning, image/video processing, mobile imaging, and color imaging. Bala is an inventor on 180 patents and has authored over 100 publications in the field of digital imaging and computer vision. He is co-editor of IEEE-Wiley book: "Computer Vision and Imaging in Intelligent Transportation Systems" and is the principal liaison for numerous industry-university partnerships. Prior to joining Amazon, Bala was principal scientist, and leader of the Collaborative Visual Computing Group at PARC. Bala is a Fellow of IS&T, and a Senior Member of IEEE.

9:30 IMAGE-265
Connecting images and AR content using CLIP embedding, *Yulong Liu, Snap (United States)*

9:50 IMAGE-266
Artificial intelligence and general data protection regulation (GDPR) – a contradiction in terms? (Invited), *Reiner Fageth, CEWE Stiftung & Co.KGaA (Germany)*

Watch What You Eat (M2.1)
Session Chair: Qian Lin, HP Inc. (United States)
10:50 AM – 12:00 PM
Balboa

10:50 IMAGE-267
Harnessing the power of pixels to assess dietary intake (Invited), *Fengqing Zhu, Purdue University (United States)*

11:20 IMAGE-268
Conditional synthetic food image generation, *Wenjin Fu[1], Yue Han[2], Sriram Baireddy[2], Jiangpeng He[2], Mridul Gupta[2], and Fengqing Zhu[2]; [1]The Ohio State University and [2]Purdue University (United States)*

11:40 IMAGE-269
Unsupervised visual representation learning on food images, *Andrew W. Peng, Jiangpeng He, and Fengqing Zhu, Purdue University (United States)*

PANEL: Watch What You Eat: Panel on Food/Health from the Perspective of AI and Privacy (M2.2)
Panel Moderator: Reiner Fageth, CEWE Stiftung & Co.KGaA (Germany)
12:00 – 12:30 PM
Balboa

Monday 16 January PLENARY: Neural Operators for Solving PDEs
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Deep learning surrogate models have shown promise in modeling complex physical phenomena such as fluid flows, molecular dynamics, and material properties. However, standard neural networks assume finite-dimensional inputs and outputs, and hence, cannot withstand a change in resolution or discretization between training and testing. We introduce Fourier neural operators that can learn operators, which are mappings between infinite dimensional spaces. They are independent of the resolution or grid of training data and allow for zero-shot generalization to higher resolution evaluations. When applied to weather forecasting, neural operators capture fine-scale phenomena and have similar skill as gold-standard numerical weather models for predictions up to a week or longer, while being 4-5 orders of magnitude faster.

Anima Anandkumar, Bren professor, California Institute of Technology, and senior director of AI Research, NVIDIA Corporation (United States)

Anima Anandkumar is a Bren Professor at Caltech and Senior Director of AI Research at NVIDIA. She is passionate about designing principled AI algorithms and applying them to interdisciplinary domains. She has received several honors such as the IEEE fellowship, Alfred. P. Sloan Fellowship, NSF Career Award, and Faculty Fellowships from Microsoft, Google, Facebook, and Adobe. She is part of the World Economic Forum's Expert Network. Anandkumar received her BTech from Indian Institute of Technology Madras, her PhD from Cornell University, and did her postdoctoral research at MIT and assistant professorship at University of California Irvine.

Prime Video (M3)
Session Chair: Raja Bala, Amazon (United States)
3:30 – 5:00 PM
Balboa

3:30 IMAGE-270
Learn spatio-temporal downsampling for effective video upscaling (Invited), *Xiaoyu Xiang[1], Yapeng Tian[2], Vijay Rengaranjan[1], Lucas Young[1], Bo Zhu[1], and Rakesh Ranjan[1]; [1]Meta and [2]The University of Texas at Dallas (United States)*

4:00 IMAGE-271
Movie character re-identification by agglomerative clustering of deep features, *Samuel Ducros[1,2], William Puech[1], Gérard Subsol[1], Mathieu Lafourcade[1], Jean-Marie Barthélémy[2], and Bianca Jansen van Rensburg[3]; [1]Université de Montpellier, [2]ECOSM, and [3]presenter only (France)*

4:20 IMAGE-272
Light-weight recurrent network for real-time video super-resolution, *Tianqi Wang[1], Qian Lin[2], and Jan P. Allebach[1]; [1]Purdue University and [2]HP Labs, HP Inc. (United States)*

4:40 IMAGE-273
Depth assisted portrait video background blurring, *Yezhi Shen[1], Weichen Xu[1], Qian Lin[2], Jan P. Allebach[1], and Fengqing Zhu[1]; [1]Purdue University and [2]HP Labs, HP Inc. (United States)*

EI 2023 Highlights Session
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
3:30 – 5:00 PM
Cyril Magnin II

Join us for a session that celebrates the breadth of what EI has to offer with short papers selected from EI conferences.

NOTE: The EI-wide "EI 2023 Highlights" session is concurrent with Monday afternoon COIMG, COLOR, IMAGE, and IQSP conference sessions.

IQSP-309
Evaluation of image quality metrics designed for DRI tasks with automotive cameras, *Valentine Klein, Yiqi LI, Claudio Greco, Laurent Chanas, and Frédéric Guichard, DXOMARK (France)*

SD&A-224
Human performance using stereo 3D in a helmet mounted display and association with individual stereo acuity, *Bonnie Posselt, RAF Centre of Aviation Medicine (United Kingdom)*

IMAGE-281
Smartphone-enabled point-of-care blood hemoglobin testing with color accuracy-assisted spectral learning, *Sang Mok Park[1], Yuhyun Ji[1], Semin Kwon[1], Andrew R. O'Brien[2], Ying Wang[2], and Young L. Kim[1]; [1]Purdue University and [2]Indiana University School of Medicine (United States)*

AVM-118
Designing scenes to quantify the performance of automotive perception systems, *Zhenyi Liu[1], Devesh Shah[2], Alireza Rahimpour[2], Joyce Farrell[1], and Brian Wandell[1]; [1]Stanford University and [2]Ford Motor Company (United States)*

VDA-403

Visualizing and monitoring the process of injection molding, *Christian A. Steinparz[1], Thomas Mitterlehner[2], Bernhard Praher[2], Klaus Straka[1,2], Holger Stitz[1,3], and Marc Streit[1,3]; [1]Johannes Kepler University, [2]Moldsonics GmbH, and [3]datavisyn GmbH (Austria)*

COIMG-155

Commissioning the James Webb Space Telescope, *Joseph M. Howard, NASA Goddard Space Flight Center (United States)*

HVEI-223

Critical flicker frequency (CFF) at high luminance levels, *Alexandre Chapiro[1], Nathan Matsuda[1], Maliha Ashraf[2], and Rafal Mantiuk[3]; [1]Meta (United States), [2]University of Liverpool (United Kingdom), and [3]University of Cambridge (United Kingdom)*

HPCI-228

Physics guided machine learning for image-based material decomposition of tissues from simulated breast models with calcifications, *Muralikrishnan Gopalakrishnan Meena[1], Amir K. Ziabari[1], Singanallur Venkatakrishnan[1], Isaac R. Lyngaas[1], Matthew R. Norman[1], Balint Joo[1], Thomas L. Beck[1], Charles A. Bouman[2], Anuj Kapadia[1], and Xiao Wang[1]; [1]Oak Ridge National Laboratory and [2]Purdue University (United States)*

3DIA-104

Layered view synthesis for general images, *Loïc Dehan, Wiebe Van Ranst, and Patrick Vandewalle, Katholieke University Leuven (Belgium)*

ISS-329

A self-powered asynchronous image sensor with independent in-pixel harvesting and sensing operations, *Ruben Gomez-Merchan, Juan Antonio Leñero-Bardallo, and Ángel Rodríguez-Vázquez, University of Seville (Spain)*

COLOR-184

Color blindness and modern board games, *Alessandro Rizzi[1] and Matteo Sassi[2]; [1]Università degli Studi di Milano and [2]consultant (Italy)*

TUESDAY 17 JANUARY 2023

KEYNOTE: Applications I (T1)
Session Chair: Raja Bala, Amazon (United States)
8:50 – 10:10 AM
Balboa

8:50 IMAGE-274
KEYNOTE: Multi-scale representations for human pose estimation: Advances and applications, *Andreas Savakis, Rochester Institute of Technology (United States)*

Prof. Andreas Savakis is director of the Center for Human-aware AI (CHAI) and Professor of Computer Engineering at the Rochester Institute of Technology. His primary area of research is computer vision, with secondary interests in computational imaging and image processing. Savakis founded the Vision and Image Processing lab (VIP-lab) at RIT, where he works with students on topics including recognition, tracking, segmentation, pose estimation, facial expression, scene analysis, domain adaptation, and robust learning.

9:30 IMAGE-275
Robust hand hygiene monitoring for food safety using hand images, *Shengtai Ju, Amy R. Reibman, and Amanda J. Deering, Purdue University (United States)*

9:50 IMAGE-276
Evaluating the efficacy of skincare product: A realistic short-term facial pore simulation, *Ling Li[1], Bandara Dissanayake[2], Tatsuya Omotezako[2], Yunjie Zhong[1], Qing Zhang[3], Rizhao Cai[1], Qian Zheng[4], Dennis Sng[1], Weisi Lin[1], Yufei Wang[5], and Alex C. Kot[1]; [1]Nanyang Technological University (Singapore), [2]Procter & Gamble (Singapore), [3]East China Normal University (China), [4]Zhejiang University (China), and [5]China-Singapore International Joint Research Institute (China)*

Applications II (T2)

Session Chair: Qian Lin, HP Inc. (United States)
10:50 AM – 12:30 PM
Balboa

10:50 IMAGE-277
AI technology for aquatic and nautical search and rescue (TANSAR), *Theus Aspiras, Ruixu Liu, and Vijayan K. Asari, University of Dayton (United States)*

11:10 IMAGE-278
Wearable spectrum imaging and telemetry at edge, *Yang Cai, CMU (United States)*

11:30 IMAGE-279
Eidetic recognition of cattle using keypoint alignment, *Manu Ramesh, Amy R. Reibman, and Jacquelyn Boerman, Purdue University (United States)*

11:50 IMAGE-280
Challenges and constraints when applying few shot learning to a real-world scenario: In-the-wild camera-trap species classification, *Haoyu Chen, Stacy Lindshield, and Amy R. Reibman, Purdue University (United States)*

12:10 IMAGE-281
Smartphone-enabled point-of-care blood hemoglobin testing with color accuracy-assisted spectral learning, *Sang Mok Park[1], Yuhyun Ji[1], Semin Kwon[1], Andrew R. O'Brien[2], Ying Wang[2], and Young L. Kim[1]; [1]Purdue University and [2]Indiana University School of Medicine (United States)*

Tuesday 17 January PLENARY: Embedded Gain Maps for Adaptive Display of High Dynamic Range Images
Session Chair: Robin Jenkin, NVIDIA Corporation (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Images optimized for High Dynamic Range (HDR) displays have brighter highlights and more detailed shadows, resulting in an increased sense of realism and greater impact. However, a major issue with HDR content is the lack of consistency in appearance across different devices and viewing environments. There are several reasons, including varying capabilities of HDR displays and the different tone mapping methods implemented across software and platforms. Consequently, HDR content authors can neither control nor predict how their images will appear in other apps.

We present a flexible system that provides consistent and adaptive display of HDR images. Conceptually, the method combines both SDR and HDR renditions within a single image and interpolates between the two dynamically at display time. We compute a Gain Map that represents the difference between the two renditions. In the file, we store a Base rendition (either SDR or HDR), the Gain Map, and some associated metadata. At display time, we combine the Base image with a scaled version of the Gain Map, where the scale factor depends on the image metadata, the HDR capacity of the display, and the viewing environment.

Eric Chan, Fellow, Adobe Inc. (United States)

Eric Chan is a Fellow at Adobe, where he develops software for editing photographs. Current projects include Photoshop, Lightroom, Camera Raw, and Digital Negative (DNG). When not writing software, Chan enjoys spending time at his other keyboard, the piano. He is an enthusiastic nature photographer and often combines his photo activities with travel and hiking.

Paul M. Hubel, director of Image Quality in Software Engineering, Apple Inc. (United States)

Paul M. Hubel is director of Image Quality in Software Engineering at Apple. He has worked on computational photography and image quality of photographic systems for many years on all aspects of the imaging chain, particularly for iPhone. He trained in optical engineering at University of Rochester, Oxford University, and MIT, and has more than 50 patents on color imaging and camera technology. Hubel is active on the ISO-TC42 committee Digital Photography, where this work is under discussion, and is currently a VP on the IS&T Board. Outside work he enjoys photography, travel, cycling, coffee roasting, and plays trumpet in several bay area ensembles.

WEDNESDAY 18 JANUARY 2023

Wednesday 18 January PLENARY: Bringing Vision Science to Electronic Imaging: The Pyramid of Visibility
Session Chair: Andreas Savakis, Rochester Institute of Technology (United States)
2:00 PM – 3:00 PM
Cyril Magnin I/II/III

Electronic imaging depends fundamentally on the capabilities and limitations of human vision. The challenge for the vision scientist is to describe these limitations to the engineer in a comprehensive, computable, and elegant formulation. Primary among these limitations are visibility of variations in light intensity over space and time, of variations in color over space and time, and of all of these patterns with position in the visual field. Lastly, we must describe how all these sensitivities vary with adapting light level. We have recently developed a structural description of human visual sensitivity that we call the Pyramid of Visibility, that accomplishes this synthesis. This talk shows how this structure accommodates all the dimensions described above, and how it can be used to solve a wide variety of problems in display engineering.

Andrew B. Watson, chief vision scientist, Apple Inc. (United States)

Andrew Watson is Chief Vision Scientist at Apple, where he leads the application of vision science to technologies, applications, and displays. His research focuses on computational models of early vision. He is the author of more than 100 scientific papers and 8 patents. He has 21,180 citations and an h-index of 63. Watson founded the Journal of Vision, and served as editor-in-chief 2001-2013 and 2018-2022. Watson has received numerous awards including the Presidential Rank Award from the President of the United States.

Imaging and Multimedia Analytics at the Edge 2023 Interactive (Poster) Paper Session
5:30 – 7:00 PM
Cyril Magnin Foyer

The following works will be presented at the EI 2023 Symposium Interactive (Poster) Paper Session.

IMAGE-282
Lightweight single pass numerical reading extraction for displays in the wild, *Yan-Ming Chiou and Bob Price, Palo Alto Research Center Incorporated (United States)*

IMAGE-283
Robust tracking of industrial objects across environments from small samples in single environments using chroma-key and occlusion augmentations, *Yan-Ming Chiou and Bob Price, Palo Alto Research Center Incorporated (United States)*